4.3 GEOTECHNICAL CONDITIONS

This section provides information regarding geotechnical conditions near the project site, including regional seismicity issues and local soil conditions. This section is based on the *Preliminary Geotechnical Investigation for the Proposed Burbank Empire Center Project* (Geotechnical Professionals, Inc., [GPI] July 14, 1999) and 12 previous investigations related to the Lockheed B-1 property, and geotechnical investigations for other projects in the vicinity of the project site as reported by Law/Crandall (November 18, 1997). Both reports are included in their entirety in Appendix F. These reports included discussions of likely foundation types that may be suitable for planned development activities within the project site. This section also includes information concerning subsurface conditions and anticipated properties of soils within the project site. This section is based on the geotechnical information currently available for the project site, as shown in Appendix F (on file at the City of Burbank).

4.3.1 EXISTING ENVIRONMENTAL SETTING

The project site is located in the southeast portion of the San Fernando Valley. The existing site grades range from about 647 feet above mean sea level (MSL) at the northeast corner of the B-1 parcel to about 592 feet MSL at the southeast corner of the B-199 parcel. The San Fernando Valley is an interior coastal basin approximately 22 miles long and 10 miles wide, and is aligned along an east-west axis. The San Fernando Valley is bounded by the Santa Susana Mountains to the north, the San Gabriel Mountains to the east, the Santa Monica Mountains to the south, and the Simi Hills to the west. Directly to the east of the project site are the Verdugo Mountains, which have been separated from the San Gabriel Mountains by faulting.

The San Fernando Valley is a down-faulted valley that has been partially filled with alluvial sediments. The San Fernando Valley slopes from the northwest to the southeast. The primary drainage system is the Los Angeles River, which runs from west to east parallel to the Santa Monica Mountains to the south of the project site. The Los Angeles River is fed by a series of intermittent tributary rivers, which flow generally from north to south. The Tujunga Wash lies to the west of the project site.

The B-1 and B-199 portions of the project site were previously occupied by buildings and structures that have since been demolished. Some of the buildings had structures extending below grade, similar to partial basements. The demolition included removal of contaminated soils. Portions of below grade structures were not removed and have been left in place. Such areas may now contain backfill that may not have been properly compacted. The subsurface conditions at the site consist of variable thicknesses of man-made fills overlying natural soils. The man-made fills consist of native and imported silty sands and sands. In general, the majority of the fills encountered have been compacted. The fills extend from one to two feet to as deep as 30 or more feet below existing site grades (GPI, 1999). The deeper fills were placed subsequent to demolition of the former Lockheed B-1 plant facility and construction of the existing VES system. Property acquisition parcels along Victory Place, Victory Boulevard, and Burbank Boulevard have existing businesses and structures on them that would be removed for the project. Foundations, parking lots, and street right-of-ways containing utilities would have to be cleared, excavated, and recompacted for the project.

Some undocumented fills (relative to geotechnical integrity) are likely present on the site and are inevitable with a project of this size. Two areas are known to contain undocumented fills that were encountered during grading and that were left in place. The first area is immediately adjacent to Victory Place, along the northeast property boundary (GPI). The other area is along the south property boundary of the proposed auto sales component on the B-1 parcel. The limits and extent of the fills are not known.

Regional Geologic Setting

The project site is located in the Transverse Ranges physiographic province which is an east-west trending belt of mountains, valleys and hills extending from the Mojave Desert east of San Bernardino to the Pacific Ocean at Point Conception. To the south, the Santa Monica Mountains form the southern boundary of the Transverse Ranges in the project vicinity.

The Transverse Ranges are composed of igneous, metamorphic and sedimentary rocks from Precambrian to Cenozoic age. The base of the central Transverse Ranges, including the project site, is believed to be composed of Mesozoic age granitic rock similar to that exposed in the nearby Verdugo and Santa Monica Mountains (GPI, 1999).

Most of the major physiographic features in the Transverse Ranges, including the San Fernando Valley and the bordering mountains, are reflections of underlying large-scale faults and folds in the earth's crust. The San Fernando Valley is a major, down-warped folded structure underlain by blind thrust faults 10 to 15 kilometers below the surface.

The faults and folds in the Transverse Ranges have formed because of compressional forces resultant from the collision of the Pacific and North American tectonic plates, whose boundaries in California are along the San Andreas fault. These tectonic forces are active at the present time, as represented by intermittent earthquake activity. The current long-term movement rate along the San Andreas fault has been determined to be approximately 34 millimeters (1.36 inches) per year. However, movement on the San Andreas fault does not relieve all regional tectonic stress. The distribution of remaining stress is responsible for the numerous faults and folds and associated earthquakes throughout southern California. Although long term movement rates on other active faults in southern California are much less than for the San Andreas fault, stresses on individual faults could have been accumulating for many thousands of years, rendering them also capable of generating damaging earthquakes.

Seismic Hazards

Regional Seismic Setting

The project site is located in a seismically active region and has been subject to a number of large earthquakes in historic times. A computer search of a State fault database determined that 44 active and potentially active faults are located within 62 miles of the project site (GPI, 1999). Although no active or potentially active faults cross the project site, three major faults located within the region have the potential to impact the site. The San Andreas Fault and the San Gabriel Fault are both located to the east and the north of the project site, and the Inglewood Fault is located to the south and to the west of the site. Other smaller faults, including the Verdugo, Sierra Madre, and Hollywood Faults, are located even closer to the project site, and also have the potential to cause severe ground shaking at the site. Recent studies have also located evidence of the existence of small faults adjacent to the project site. These faults are unnamed, and their potential to impact the site is currently unknown. The site is not located in a Alquist-Priolo Earthquake Fault Hazard Zone. Figure 4.3.1 illustrates the project site in relation to faults in the regional area.

Southern California is a geologically complex area that includes several types of fault systems, including strike-slip, oblique, thrust, and blind thrust. Any given area is subject to seismic hazards of varying degree, depending on the proximity and earthquake potential of nearby active faults and the local geologic and topographic conditions, which can either amplify or attenuate the seismic waves. Seismic hazards include primary hazards from surface rupturing of rock and soil materials along active fault traces and secondary hazards resulting from strong ground shaking.

Local Faults

The closest potentially active fault to the site is the Verdugo fault, which is approximately 3,750 feet to one mile to the northeast of the site (GPI, 1999). The Verdugo fault is up to one-half mile wide and ten miles long, running generally from the north-west to the southeast approximately one mile east of the project site. The Verdugo fault is believed to be a steeply north-dipping reverse fault. Movement on the fault is believed responsible for the uplift of the Verdugo Mountains above the level of the San Fernando Valley. The State of California does not zone the fault as active.

Reverse-type displacements on regional surface faults, including the nearby Verdugo and Hollywood-Santa Monica fault systems, are expressions of deep-seated crustal compression. Recent earthquakes and seismic investigations have demonstrated the presence of numerous “blind thrust” faults in the Los Angeles area. These active faults lie at a depth of approximately 8 to 20 kilometers and do not intersect the ground surface. They represent a significant, but difficult to quantify, seismic risk. The 1994 Northridge Earthquake has been ascribed to a blind thrust fault termed the “Pico Thrust” (GPI, 1999). The Elysian Park Thrust System is believed to underlie most of the San Fernando Valley, including the project site.

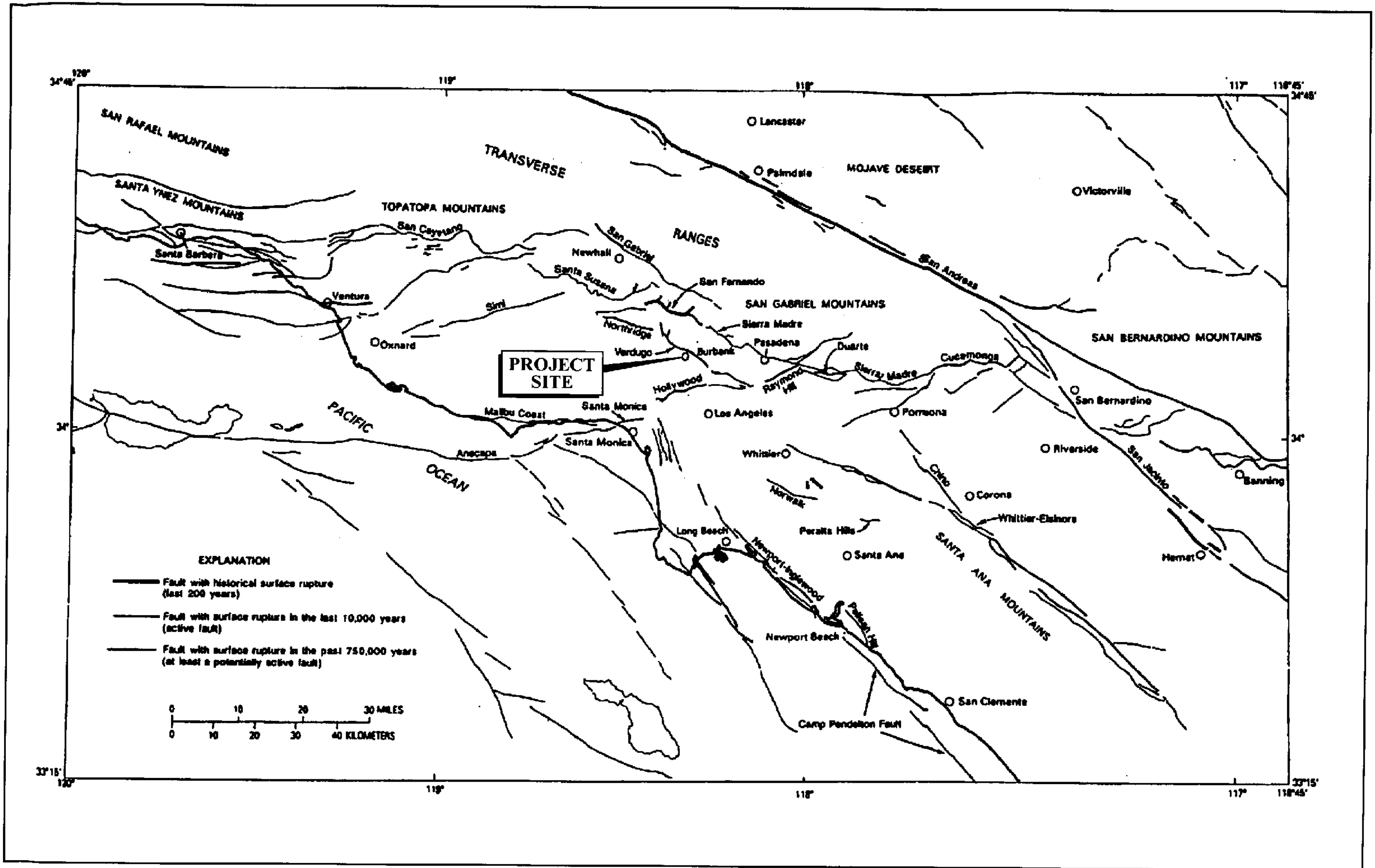

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Figure 4.3.1

Regional Fault Map

Several inferred fault traces have been mapped in the vicinity of the site, including the recently postulated Burbank fault. None of these faults are shown to cross the site; at its closest point to the site, the Burbank fault is shown to be about 500 feet northeast of the property. These inferred faults have been postulated based on very limited groundwater evidence and geophysical surveys, and are shown as buried beneath the ground surface. However, there is no definitive evidence as to the existence or age of these faults. Based on the lack of surface expression, it is unlikely that these faults are active. Also, based on fault activity maps prepared by the State of California, these faults are not shown as active or potentially active.

Other potentially active faults have also been identified in the vicinity of the project site. These are unnamed basin faults, and very little information exists on them. The first of these faults is approximately one-half mile south of the project site in the vicinity of Victory Boulevard. This fault may possibly be four miles long, running generally parallel to Victory Boulevard from west-northwest to east-southeast. The second fault is approximately two miles southwest of the project site following the Whitnall Highway from the Burbank-North Hollywood boundary to Chandler Boulevard and tending due east to Magnolia Boulevard. The third fault runs east-west from the vicinity of St. Joseph's Hospital to the intersection of Western Avenue and the Golden State Freeway. The final unnamed fault runs parallel with the Los Angeles Flood Control Channel along the southwestern boundary of the City of Burbank, approximately three miles south of the project site.

Better known and extensively studied faults include the San Andreas, the San Fernando, the Sierra Madre, and the Hollywood Faults. Predictions of the maximum credible event happening along these faults within the next 100 years have been estimated, along with the probable impacts upon the City of Burbank. The San Andreas has the greatest possibility of having a 7.5 magnitude earthquake within the next 100 years. The impact on the project site is expected to be minimal. There is also a high probability of a magnitude 6.6 earthquake on the San Fernando Fault. This event would result in seismic intensities similar to the 1971 San Fernando Earthquake. The Sierra Madre Fault has the potential to produce an earthquake with an intensity of 8.5 in the Burbank area; however, the chance of an earthquake of this magnitude is considered low. The Hollywood Fault is also considered to have a low probability of producing an earthquake within the next 100 years, although should this happen in the worst case the seismic intensities could approach 10.0 on the MM Scale.

Historic Seismic Ground Shaking

The two largest earthquakes to affect the site and the City of Burbank in recent times were the 1971 San Fernando earthquake with a magnitude 6.6 and the 1994 Northridge earthquake with a magnitude of 6.7. Epicenters for these events were located approximately 15 miles northwest and 11 miles west of the project site, respectively.

Maximum horizontal ground accelerations in the site vicinity during the Northridge Earthquake approximated 0.33g (1g = force of gravity = 980 cm/sec/sec) according to a contoured map of instrumentally determined motions (GPI, 1999). A map prepared by the Governor's Office of Emergency Services (March 8, 1994) indicates that the area of the project site, and almost all of Burbank, experienced shaking during the Northridge Earthquake equivalent to Modified Mercalli Intensity VIII on a scale from I to XII, XII being highest. Intensity Level VIII is described briefly as heavy damage to unreinforced Class C masonry and some damage to reinforced Class B masonry of good workmanship.

Earthquake accelerations at the site from the 1971 San Fernando Earthquake were probably generally equivalent to the values experienced during the Northridge Earthquake. According to the predicted intensities in U.S. Geological Survey Professional Paper 1360, the Northridge Earthquake was approximately equivalent to the largest expected shaking intensity at the site (GPI, 1999).

Liquefaction Potential

Soil liquefaction is a phenomenon in which saturated cohesionless soils undergo a temporary loss of strength during severe ground shaking and acquire a degree of mobility sufficient to permit ground deformation. In extreme cases, the soil particles can become suspended in groundwater, resulting in the soil deposit becoming mobile and fluid-like. Liquefaction is generally considered to occur primarily in loose to medium dense deposits of saturated soils. Thus, three conditions are required for liquefaction to occur: 1) a cohesionless soil of loose to medium density; 2) a saturated condition; and 3) rapid large strain, cyclic loading normally provided by earthquake motions.

Geotechnical studies conducted in conjunction with the preparation of the current Seismic Safety Element of the General Plan and more recent studies conducted as part of preparing for a revision of this General Plan Element have identified areas of potential liquefaction within the City of Burbank. None of these areas are located on the project site. However, in 1998, the State Division of Mines and Geology published maps of seismic hazards including Burbank. These maps classify areas in terms of susceptibility to liquefaction and slope failure and, among other things, have the purpose of requiring site-specific hazard investigations for areas deemed susceptible. With respect to liquefaction, the criteria for susceptibility are the depth to the water table and the presence or absence of recent alluvial sediments. Using these criteria, the project site is located within an area determined to be susceptible to liquefaction. The majority of the site is included in a Liquefaction Hazards Zone (GPI, 1999). Although the project site is identified as being in a Liquefaction Hazards Zone, this does not necessarily indicate that this liquefaction exists on the site. It only indicates that characteristics of the site require investigation of this hazard.

Soils

The geology of the San Fernando Valley consists of three general groups of rocks and sediments. The surface deposits consist of Quaternary alluvium deposits. These deposits consist of the Saugus Formation laid down in the early Pleistocene Epoch (beginning one to two million years before present) and various continental and marine conglomerates, sands, silts, and clays. This formation is overlaid by the Older Alluvium formation laid down between 10,000 and 100,000 years before present, and consists of gravel, sands, silts, and clays. The surface, and most recent formation, is the Younger Alluvium, which was laid down during the Holocene Epoch (up to 10,000 years before present). At the project site, these soils generally consist of sand and gravel, which reflects their origin in the Verdugo and San Gabriel Mountains. The current (1990) and the new (1999) Seismic Hazards Constraint Map for the City of Burbank show the alluvium to be a mixture of fine-grained stream channel deposits. The alluvial deposits are predominantly sandy in nature. The natural soils occurring below the fills consist of alluvial deposits of silty sands, sands and locally, gravels and cobbles. Where they occur within 15 to 20 feet of the existing ground surface, the consistency of these materials range from medium dense with layers of loose materials. These layers of loose materials are typically one to five feet thick. Below these alluvium deposits are a group of sedimentary rocks laid down late in the Mesozoic Era (Cretaceous Period) and the early to middle Cenozoic Era (Tertiary Period).

These rocks are primarily of marine origin, and range in age from 2 to 65 million years before present. These rocks and those below them have been extensively faulted by tectonic events starting in the Tertiary Period. The deepest and oldest rock formation underlying the project site are crystalline basement rocks, the youngest of which were laid down in the late Mesozoic Era (Cretaceous Period), and are at least 65 million years old. The oldest rock formations underlying the project site consist of Precambrian Era gneiss (metamorphic); an outcropping of these basement rocks form the Verdugo Mountains.

Groundwater

In general, it is known that groundwater levels in the San Fernando Valley correlate closely with climatic cycles of wet and dry years. Prior to artificial recharge of the groundwater basins, the basin would fill during a cycle of wet years and spillage would occur to the Los Angeles River. Conversely during periods of drought, groundwater levels would fall significantly. Groundwater resources in the San Fernando Valley have been adjudicated and subject to management and regulation for decades, primarily under the jurisdiction of the City of Los Angeles Department of Water and Power.

Historically, a relatively uniform depth to groundwater of 40 to 50 feet has been identified beneath the site (GPI, 1999). The source of this information was taken from records compiled by the Los Angeles County Flood Control District for wells drilled from 1937 to 1960. A map showing historic depth to shallow groundwater in the Los Angeles County Seismic Safety Element indicated a narrow, oval-shaped area of shallow groundwater parallel to the Golden State Freeway that intruded slightly into the southeast corner of the project site at depths of approximately 30 to 50 feet.

The current Seismic Safety Element for the City of Burbank (1997) includes a Seismic Hazards Constraint Map showing a small portion in the southeast corner of the site with a depth to groundwater of less than 30 feet. However, the revised City of Burbank Seismic Hazards Constraints Map (1999) indicates a large portion of the City, including the entire project site, with groundwater as shallow as 40 feet. This map is based on, and conformable with, a recent State Division of Mines and Geology Final Seismic Hazards Map of the Burbank Quadrangle.

Recent monitoring of groundwater wells (1992, 1997, and 1998) indicates that groundwater occurs at approximate depths of 110 to 160 feet below existing site grades; groundwater was not encountered during the test explorations performed for the geotechnical reporting for the proposed project (GPI, 1999). Additionally, caving was not observed in the test borings; however, excavations in the clean sands underlying the site will have a potential for caving if exposed in site excavations (GPI, 1999).

4.3.2 THRESHOLD OF SIGNIFICANCE CRITERIA

The effects of a project due to geology and seismicity are considered to be significant if the proposed project results in any of the following:

- Exposure of people or structures to geological hazards, such as landslides, mudslides, seismic related ground failure, or substantial erosion; soil and/or seismic conditions so unfavorable that they could not be overcome by design, using reasonable construction and/or maintenance practices.

- Soil incompetent for use as a foundation.

- Earthquake induced ground shaking capable of causing ground rupture, liquefaction, settlement, or surface cracks resulting in the substantial loss of use.

- Location of a structure on a fault known to be capable of rupture, as delineated on the Alquist-Priolo Earthquake Fault Zoning map or based on substantial evidence of a known fault.

- Location of structures on expansive soils (those characterized by excessive shrink/swell potential, as defined in Table 18-1-B of the UBC (1994)), creating substantial risks to life or property.

4.3.3 IMPACTS - DEVELOPMENT OPTION A

Less than Significant Impacts

Liquefaction Potential

According to GPI (1999), the occurrence of liquefaction on the project site is unlikely. The analysis assumed a historic depth to groundwater of 40 feet, a ground motion of 0.47 (magnitude weighted for M7.5), and the subsurface conditions encountered. Due to the depth of groundwater (historic) and the dense sands or cohesive soils (silts and clays) encountered below 25 feet, the likelihood of liquefaction occurring on the project site is unlikely. Therefore, the potential for liquefaction is considered less than significant.

Ground Rupture

There are no known faults crossing or projecting through the project site. The site is not located in an Alquist-Priolo Study Zone. Therefore, ground rupture due to faulting is considered unlikely on the project site and is considered less than significant.

Landslides

Due to the level topography of the project site, the site is not prone to landslides or mudslides.

Potentially Significant Impacts

Seismic Ground Motion

As with all of Southern California, the project site will be subject to strong ground motions resulting from earthquakes on nearby faults. No active or potentially active faults are known to cross the site. The site could be subject to ground motions of 0.62 g, a ground motion having a 10 percent chance of exceedance in 50 years (GPI, 1999), from a possible earthquake from these nearby faults. As required by existing State and local building codes, structures on the project site are required to be designed in accordance with the current edition of the Uniform Building Code and/or City Building Code to withstand seismic activity caused by regional faulting. Compliance with the Uniform Building Code and/or City Building Code, will minimize the potentially damaging effect of severe ground shaking originating from earthquakes in the region.

Erosion

During the construction phase of Development Option A, newly graded areas would be exposed to increased erosion potential as a result of rainfall on site or watering activities to reduce fugitive dust. If grading is conducted during the winter months, exposed soils in newly graded areas or stockpiles could become entrained in stormwater runoff and cause siltation within the local storm drain system. Prior to initiation of project construction, a grading permit will need to be issued by the City of Burbank. The grading permit will require the implementation of specific erosion control measures and best management practices (BMPs). Compliance with the provisions contained in the grading permit and conditions of the Storm Water Pollution Prevention Program (SWPPP), outlined in Section 4.4, Water Resources, will reduce potential erosional impacts to below a significant level.

Subsidence and Shrinkage

Grading of the site will require importing approximately 232,000 cubic yards (cy) of soil for shrinkage, and on-site blending and grading of material and approximately 561,000 cy of overexcavation (on-site soil removal and recompaction). During the recompaction process, it is estimated that excavated soils are likely to shrink on the order of 10 to 20 percent, with subsidence of 0.1 to 0.2 feet for surficial natural soils.

The on-site soils are well suited for use in compacted fills. These soils can readily be compacted to specified 90 percent or 95 percent of maximum dry density determined by the ASTM Designation D1557-91. The on-site sands and silty sands, when compacted to at least 90 percent, will provide very good subgrade for proposed paved parking areas. Pavements at the site, assuming typical traffic loads, are expected to consist of three inches of asphalt-concrete over four to eight inches of aggregate base. Under structures with floor slabs that are subjected to forklift traffic and in pavement areas, it is recommended that the upper 12 inches of the subgrade be compacted to 95 percent (GPI, 1999).

The moisture content of the fill materials should be at optimum or within two percent over optimum to readily achieve the required degree of compaction. The moisture content of the existing near-surface soils is, in general, below optimum (GPI, 1999). It is expected that moisture conditions will change over time, depending on weather conditions. Should construction be performed during the summer and fall months, the existing moisture contents will be drier (i.e., below optimum). Therefore, moistening of existing near-surface soils would be expected during summer month construction.

Implementation of Mitigation Measures 3.1 through 3.4 are required to reduce potentially significant effects of subsidence and shrinkage to below a level of significance.

Soil Densification

Portions of the site are underlain by natural sandy soils that exhibit a potential for densification and resulting settlement upon moistening. This process is referred to as hydroconsolidation or collapsible soils. Where a building is supported either entirely on the natural materials or on these materials and compacted fills, a potential exists for large magnitude differential settlement (several inches over short distances) if the materials get wet. The existing collapsible soils and undocumented fills within the proposed building pads should be removed and replaced as properly compacted fill, where not removed by cut. The building pad includes any attached structures, including canopies, storage areas, trash enclosures, etc.

Through refined design, structural foundation design, and soil engineering, the project will incorporate structural engineering that will avoid impacts due to any adverse soil conditions on the site. Proposed structures are expected to be three stories or less in height and can be supported on spread footings founded on properly compacted fills (GPI, 1999). Slab-on-grade floors are anticipated. Lighter buildings, with no basements, can be supported on spread footings established in undisturbed natural soils or properly compacted fill imposing relatively low soil pressures. It is estimated that loads up to 700 kips can be safely supported by the on-site soils within total and differential settlements on the order of one inch and one-half inch, respectively (GPI, 1999). If significantly heavier/lighter structures are planned in the future, deeper removal or pile foundations may be required (GPI, 1999).

Significant Impacts

There are no significant geotechnical related impacts associated with Development Option A.

4.3.4 MITIGATION MEASURES - DEVELOPMENT OPTION A

3.1 Prior to issuance of grading permits, project grading plans and structural plans for all buildings shall incorporate soil and seismic foundation recommendations of an updated soils and geotechnical report; these recommendations shall be confirmed after a comprehensive design level geotechnical investigation of the site, as presented in a "Final Soils and Geotechnical" report. All potential project effects are fully described in the GPI (1999) Report; an updated geotechnical report is necessary to incorporate refinements and building specific soil and foundation recommendations into final project design. Incorporation of recommended site preparation and compaction features shall be confirmed by the City of Burbank Engineering Department, Public Works Agency, prior to approval of final grading plans. Particular attention shall be paid to overexcavation of soil and recompaction of building areas and parking lot areas. The following soil removal and compaction standards shall apply:

1. Loose sands and soil classified as collapsible or soils subject to hydroconsolidation not suitable for structural support shall be removed and recompacted. Removals shall extend laterally beyond the building line a minimum distance equal to the depth of overexcavation below finish grade (i.e., a 1:1 projection below the edge of footings). The lateral limits should extend a minimum of five feet and a maximum of ten feet beyond building lines (i.e., canopies, storage areas, enclosures, etc.). Overexcavation and densification shall be required in the areas under planned building foundations, dependent upon final structural design load, per UBC requirements.

2. Additional densification below areas of soil removal can be achieved by in-place compaction, depending upon final structural load design, per UBC requirements.

3. In shallow excavations where workmen enter, the area shall be properly shored or sloped back at least 1:1 (horizontal:vertical) or flatter. Excavations in compacted fill or dense natural soils may be cut up to four feet vertically. Excavations deeper than four feet in compacted fill or in clean sands shall be shored or sloped back 1:1. Surcharge loads shall not be permitted within a horizontal distance equal to the height of cut from the toe of the excavation or five feet from the top of the slopes, whichever is greater, unless the cut is properly shored. Excavations that extend below an imaginary plane, inclined at 45 degrees below the edge of any adjacent existing site facilities, shall be properly shored to maintain support of adjacent elements. All excavations and shoring systems shall meet the minimum requirements given in the most current State of California Occupational Safety and Health Standards. Soil densification is required in all areas, consistent with UBC requirements and recommendations in the Final Soils and Geotechnical report.

3.2 To ensure stability in imported fill material, all imported fill material should be predominantly granular, non-expansive and contain no more than 40 percent fines (portion passing No. 200 sieve) and have a minimum R-value of 50. The Geotechnical Engineer shall be notified at least 72 hours in advance of importing soils. Each proposed import source shall be sampled, tested, and accepted for use by the Geotechnical Engineer prior to delivery of the soils to site. Imported soils to be used as fill shall be free of debris and not be larger than six inches in dimension. Soils imported prior to acceptance by the Geotechnical Engineer may be rejected if not deemed suitable. The Geotechnical Engineer shall maintain a daily log indicating source of material and placement of material. Prior to issuance of building permits, the Geotechnical Engineer shall furnish the log to the Director, Community Development Department, for review and approval.

3.3 Many of the demolished buildings were supported on drilled piles; although unlikely, encountering such piling during site grading should be anticipated. Proposed excavations shall be reviewed by the City of Burbank Engineering Department prior to approval of grading permits. Should former foundations be encountered, they shall be removed. In addition, grading plans shall specify a grading monitoring program. The monitoring program shall be reviewed and approved by the Engineering Department to ensure the following:

1. Prior to placing any fills, the exposed subgrade (both existing grades or after removals are complete) should be scarified, moisture conditioned (flooded), and proofrolled using a heavy vibratory pad foot roller with a minimum rated energy of 40,000 pounds (dynamic). All subgrades in building areas shall be proofrolled a minimum of six passes. A minimum of four passes shall be made in pavement areas.

2. Prior to grading, the areas to be developed shall be stripped of any vegetation and cleared of all debris, structures, aboveground soil stockpiles, and pavements. All buried obstructions, such as footings, utilities, and tree roots, shall also be removed. All deleterious materials generated during the clearing operations shall be removed from the site. Inert demolition debris, such as concrete and asphalt, may be crushed for re-use in engineered fills in accordance with the criteria identified in Mitigation Measure 3.2. The site shall be cleared to the approval of the Geotechnical Engineer and the City of Burbank Engineering Department prior to issuance of grading permits.

3. To ensure site safety, temporary vertical cuts should be limited to less than three feet within the upper silty sand soils. Excavations deeper than three feet should be sloped at 1:1 or supported by temporary side walls.

3.4 Planter design shall be included in site building plans submitted for plan check and subject to approval of the City of Burbank Engineering Department prior to approval of building permits. To ensure that unexcavated collapsible soils are not affected, all planters within 20 feet of buildings shall be lined and drained to appropriate collection facilities so that these soils are not affected.

4.3.5 CUMULATIVE IMPACTS - DEVELOPMENT OPTION A

Project impacts noted above are site specific. Development Option A project impacts are mitigated individually, and will not have a significant, cumulative impact in terms of geologic/soils conditions.

4.3.6 LEVEL OF SIGNIFICANCE AFTER MITIGATION - DEVELOPMENT OPTION A

Collapsible soils in the building areas will be mitigated to below a level of significance through the excavation and recompaction of these soils in place, as identified in Mitigation Measure 3.3. Additionally, potential subsurface water sources (i.e., planters) will be required to be lined and drained to appropriate collection facilities, as outlined in Mitigation Measure 3.4. Implementation of Mitigation Measures 3.3 and 3.4 will reduce potentially significant effects to collapsible soils to below a level of significance.

With mitigation, the project will not result in any significant, unavoidable impacts related to geology or seismicity.

4.3.7 IMPACTS - DEVELOPMENT OPTION D1-A

Less than Significant Impacts

Liquefaction

Similar to Development Option A, the occurrence of liquefaction on the project site is unlikely. The existing site conditions are unchanged from Development Option A, therefore, the potential for liquefaction is considered less than significant. Mitigation measures are not warranted.

Ground Rupture

Similar to Development Option A, there are no known faults crossing or projecting through the project site. The site is not located in an Alquist-Priolo special studies zone. Therefore, ground rupture due to faulting is considered unlikely on the project site and is considered less than significant.

Landslides

Due to the topography of the project site, the site is not prone to landslides or mudslides.

Potentially Significant Impacts

Seismic Ground Motion

Similar to Development Option A, the project site will be subject to strong ground motions resulting from earthquakes on nearby faults. The site could be subject to ground motions of 0.62 g, a ground motion having a 10 percent chance of exceedance in 50 years (GPI, 1999). As required by existing State and local laws, structures on the project site shall be designed in accordance with the current edition of the Uniform Building Code and/or City Building Code. Compliance with the Uniform Building Code and/or City Building Code will minimize the potentially damaging effect of severe ground shaking originating from earthquakes in the region.

Erosion

The potential for erosion is unchanged from Development Option A. Newly graded areas would be exposed to increased erosion potential as a result of rainfall on site or watering activities to reduce fugitive dust. If grading is conducted during the winter months, exposed soils in newly graded areas or stockpiles could become entrained in stormwater runoff and cause siltation within the local storm drain system. Prior to initiation of project construction, a grading permit will need to be issued by the City of Burbank. The grading permit will require the implementation of specific erosion control measures and best management practices (BMPs). Compliance with the provisions contained in the grading permit and conditions of the Storm Water Pollution Prevention Program (SWPPP), outlined in Section 4.4, Water Resources, will reduce potential erosional impacts to below a significant level.

Subsidence and Shrinkage

Grading of the site for Development Option D1-A will require importing approximately 232,000 cy of soil for shrinkage and on-site blending and grading of material and approximately 561,000 cy of overexcavation (on-site soil removal and recompaction). During the recompaction process, it is estimated that excavated soils are likely to shrink on the order of 10 to 20 percent, with subsidence of 0.1 to 0.2 feet for surficial natural soils.

The condition of on-site soils is unchanged from Development Option A. These soils can readily be compacted to specified 90 percent or 95 percent of maximum dry density determined by the ASTM Designation D1557-91. The on-site sands and silty sands, when compacted to at least 90 percent, will provide very good subgrade for proposed paved parking areas. Pavements at the site, assuming typical traffic loads are expected to consist of three inches of asphalt-concrete over four to eight inches of aggregate base. Under structures with floor slabs that are subjected to forklift traffic and in pavement areas, it is recommended that the upper 12 inches of the subgrade be compacted to 95 percent (GPI, 1999).

The moisture content of the fill materials should be at optimum or within two percent over optimum to readily achieve the required degree of compaction. The moisture content of the existing near-surface soils is, in general, below optimum (GPI, 1999). It is expected that moisture conditions will change over time, depending on weather conditions. Should construction be performed during the summer and fall months, the existing moisture contents will be drier (i.e., below optimum). Therefore, moistening of existing near-surface soils would be expected during summer month construction.

Implementation of Mitigation Measures 3.1 through 3.4 will reduce potentially significant effects of subsidence and shrinkage to below a level of significance.

Soil Densification

Portions of the site are underlain by natural sandy soils that exhibit a potential for densification and resulting settlement upon moistening. This process is referred to as hydroconsolidation or collapsible soils. Where a building is supported either entirely on the natural materials or on these materials and compacted fills, a potential exists for large magnitude differential settlement (several inches over short distances) if the materials get wet. The existing collapsible soils and undocumented fills within the proposed building pads should be removed and replaced as properly compacted fill, where not removed by cut. The building pad includes any attached structures, including canopies, storage areas, trash enclosures, etc.

Through design, the project will incorporate structural designs that will avoid impacts due to any adverse soil conditions on the site. Proposed structures are expected to be three stories or less in height and can be supported on spread footings founded on properly compacted fills (GPI, 1999). Slab-on-grade floors are anticipated. Lighter buildings, with no basements, can be supported on spread footings established in undisturbed natural soils or properly compacted fill imposing relatively low soil pressures. It is estimated that loads up to 700 kips can be safely supported by the on-site soils within total and differential settlements on the order of one inch and one-half inch, respectively (GPI, 1999). If significantly heavier/lighter structures are planned in the future, deeper removal or pile foundations may be required (GPI, 1999).

Collapsible soils in the building areas will be mitigated to below a level of significance through the excavation and recompaction of these soils in place, as identified in Mitigation Measure 3.3. Additionally, potential subsurface water sources (i.e., planters) will be required to be lined and drained to appropriate collection facilities, as outlined in Mitigation Measure 3.4. Implementation of Mitigation Measures 3.3 and 3.4 will reduce potentially significant effects to collapsible soils to below a level of significance.

Significant Impacts

There are no significant geotechnical related impacts associated with Development Option D1-A.

4.3.8 MITIGATION MEASURES - DEVELOPMENT OPTION D1-A

The mitigation measures for Development Option A also apply to Development Option D1-A.

4.3.9 CUMULATIVE IMPACTS - DEVELOPMENT OPTION D1-A

Similar to Development Option A, project impacts are site specific. Development Option D1-A project impacts are mitigated individually, and will not have a significant, cumulative impact in terms of geologic/soil conditions.

4.3.10 LEVEL OF SIGNIFICANCE AFTER MITIGATION - DEVELOPMENT OPTION D1-A

Similar to Development Option A, Development Option D1-A will not result in any significant, unavoidable impacts related to geology or seismicity.

4.3.11 IMPACTS - DEVELOPMENT OPTION D1-B

Less than Significant Impacts

Liquefaction

Similar to Development Option A, the occurrence of liquefaction on the project site is unlikely. The existing site conditions are unchanged from Development Option A, therefore, the potential for liquefaction is considered less than significant. Mitigation measures are not warranted.

Ground Rupture

Similar to Development Option A, there are no known faults crossing or projecting through the project site. The site is not located in an Alquist-Priolo special studies zone. Therefore, ground rupture due to faulting is considered unlikely on the project site and is considered less than significant.

Landslides

Due to the topography of the project site, the site is not prone to landslides or mudslides.

Potentially Significant Impacts

Seismic Ground Motion

Similar to Development Option A, the project site will be subject to strong ground motions resulting from earthquakes on nearby faults. The site could be subject to ground motions of 0.62 g, a ground motion having a 10 percent chance of exceedance in 50 years (GPI, 1999). As required by existing State and local laws, structures on the project site shall be designed in accordance with the current edition of the Uniform Building Code and/or City Building Code. Compliance with the Uniform Building Code and/or City Building Code will minimize the potentially damaging effect of severe ground shaking originating from earthquakes in the region.

Erosion

The potential for erosion is unchanged from Development Option A. Newly graded areas would be exposed to increased erosion potential as a result of rainfall on site or watering activities to reduce fugitive dust. If grading is conducted during the winter months, exposed soils in newly graded areas or stockpiles could become entrained in stormwater runoff and cause siltation within the local storm drain system. Prior to initiation of project construction, a grading permit will need to be issued by the City of Burbank. The grading permit will require the implementation of specific erosion control measures and best management practices (BMPs). Compliance with the provisions contained in the grading permit and conditions of the Storm Water Pollution Prevention

Program (SWPPP), outlined in Section 4.4, Water Resources, will reduce potential erosional impacts to below a significant level.

Subsidence and Shrinkage

Grading of the site for Development Option D1-B will require importing approximately 232,000 cy of soil for shrinkage and on-site blending and grading of material and approximately 561,000 cy of overexcavation (on-site soil removal and recompaction). During the recompaction process, it is estimated that excavated soils are likely to shrink on the order of 10 to 20 percent.

The condition of on-site soils is unchanged from Development Option A. These soils can readily be compacted to specified 90 percent or 95 percent of maximum dry density determined by the ASTM Designation D1557-91. The on-site sands and silty sands, when compacted to at least 90 percent, will provide very good subgrade for proposed paved parking areas. Pavements at the site, assuming typical traffic loads are expected to consist of three inches of asphalt-concrete over four to eight inches of aggregate base. Under structures with floor slabs that are subjected to forklift traffic and in pavement areas, it is recommended that the upper 12 inches of the subgrade be compacted to 95 percent (GPI, 1999).

The moisture content of the fill materials should be at optimum or within two percent over optimum to readily achieve the required degree of compaction. The moisture content of the existing near-surface soils is, in general, below optimum (GPI, 1999). It is expected that moisture conditions will change over time, depending on weather conditions. Should construction be performed during the summer and fall months, the existing moisture contents will be drier (i.e., below optimum). Therefore, moistening of existing near-surface soils would be expected during summer month construction.

Implementation of Mitigation Measures 3.1 through 3.4 will reduce potentially significant effects of subsidence and shrinkage to below a level of significance.

Soil Densification

Portions of the site are underlain by natural sandy soils that exhibit a potential for densification and resulting settlement upon moistening. This process is referred to as hydroconsolidation or collapsible soils. Where a building is supported either entirely on the natural materials or on these materials and compacted fills, a potential exists for large magnitude differential settlement (several inches over short distances) if the materials get wet. The existing collapsible soils and undocumented fills within the proposed building pads should be removed and replaced as properly compacted fill, where not removed by cut. The building pad includes any attached structures, including canopies, storage areas, trash enclosures, etc.

Through design, the project will incorporate structural designs that will avoid impacts due to any adverse soil conditions on the site. Proposed structures are expected to be three stories or less in height and can be supported on spread footings founded on properly compacted fills (GPI, 1999). Slab-on-grade floors are anticipated. Lighter buildings, with no basements, can be supported on spread footings established in undisturbed natural soils or properly compacted fill imposing relatively low soil pressures. It is estimated that loads up to 700 kips can be safely supported by the on-site soils within total and differential settlements on the order of one inch and one-half inch, respectively (GPI, 1999). If significantly heavier/lighter structures are planned in the future, deeper removal or pile foundations may be required (GPI, 1999).

Collapsible soils in the building areas will be mitigated to below a level of significance through the excavation and recompaction of these soils in place, as identified in Mitigation Measure 3.3. Additionally, potential subsurface water sources (i.e., planters) will be required to be lined and drained to appropriate collection facilities, as outlined in Mitigation Measure 3.4. Implementation of Mitigation Measures 3.3 and 3.4 will reduce potentially significant effects to collapsible soils to below a level of significance.

Significant Impacts

There are no significant geotechnical related impacts associated with Development Option D1-B.

4.3.12 MITIGATION MEASURES - DEVELOPMENT OPTION D1-B

The mitigation measures for Development Option A also apply to Development Option D1-B.

4.3.13 CUMULATIVE IMPACTS - DEVELOPMENT OPTION D1-B

Similar to Development Option A, project impacts are site specific. Development Option D1-B project impacts are mitigated individually, and will not have a significant, cumulative impact in terms of geologic/soil conditions.

4.3.14 LEVEL OF SIGNIFICANCE AFTER MITIGATION - DEVELOPMENT OPTION D1-B

Similar to Development Option A, Development Option D1-B will not result in any significant, unavoidable impacts related to geology or seismicity.

4.3.15 IMPACTS - DEVELOPMENT OPTION D1-C

Less than Significant Impacts

Liquefaction

Similar to Development Option A, the occurrence of liquefaction on the project site is unlikely. The existing site conditions are unchanged for Development Option A; therefore, the potential for liquefaction is considered less than significant. Mitigation measures are not warranted.

Ground Rupture

Similar to Development Option A, there are no known faults crossing or projecting through the project site. The site is not located in an Alquist-Priolo special studies zone. Therefore, ground rupture due to faulting is considered unlikely on the project site and is considered less than significant.

Landslides

Due to the topography of the project site, the site is not prone to landslides or mudslides.

Potentially Significant Impacts

Seismic Ground Motion

Similar to Development Option A, the project site will be subject to strong ground motions resulting from earthquakes on nearby faults. The site could be subject to ground motions of 0.62 g, a ground motion having a ten percent chance of exceedance in 50 years (GPI, 1999). As required by existing State and local laws, structures on the project site shall be designed in accordance with the current edition of the Uniform Building Code and/or City Building Code. Compliance with the Uniform Building Code and/or City Building Code will minimize the potentially damaging effect of severe ground shaking originating from earthquakes in the region.

Erosion

The potential for erosion is unchanged from Development Option A. Newly graded areas would be exposed to increased erosion potential as a result of rainfall on site or watering activities to reduce fugitive dust. If grading is conducted during the winter months, exposed soils in newly graded areas or stockpiles could become entrained in stormwater runoff and cause siltation within the local storm drain system. Prior to initiation of project construction, a grading permit will need to be issued by the City of Burbank. The grading permit will require the implementation of specific erosion control measures and best management practices (BMPs). Compliance with the provisions contained in the grading permit and conditions of the Storm Water Pollution Prevention Program (SWPPP), outlined in Section 4.4, Water Resources, will reduce potential erosional impacts to below a significant level.

Subsidence and Shrinkage

Grading of the site for Development Option D1-C will require importing approximately 232,000 cy of soil for shrinkage and on-site blending and grading of material and approximately 561,000 cy of overexcavation (on-site soil removal and recompaction). During the recompaction process, it is estimated that excavated soils are likely to shrink on the order of 10 to 20 percent.

The condition of on-site soils is unchanged from Development Option A. These soils can readily be compacted to specified 90 percent or 95 percent of maximum dry density determined by the ASTM Designation D1557-91. The on-site sands and silty sands, when compacted to at least 90 percent, will provide very good subgrade for proposed paved parking areas. Pavements at the site, assuming typical traffic loads, are expected to consist of three inches of asphalt-concrete over four to eight inches of aggregate base. Under structures with floor slabs that are subjected to forklift traffic and in pavement areas, it is recommended that the upper 12 inches of the subgrade be compacted to 95 percent (GPI, 1999).

The moisture content of the fill materials should be at optimum or within two percent over optimum to readily achieve the required degree of compaction. The moisture content of the existing near-surface soils is, in general, below optimum (GPI, 1999). It is expected that moisture conditions will change over time, depending on weather conditions. Should construction be performed during the summer and fall months, the existing moisture contents will be drier (i.e., below optimum). Therefore, moistening of existing near-surface soils would be expected during summer month construction.

Implementation of Mitigation Measures 3.1 through 3.4 will reduce potentially significant effects of subsidence and shrinkage to below a level of significance.

Soil Densification

Portions of the site are underlain by natural sandy soils that exhibit a potential for densification and resulting settlement upon moistening. This process is referred to as hydroconsolidation or collapsible soils. Where a building is supported either entirely on the natural materials or on these materials and compacted fills, a potential exists for large magnitude differential settlement (several inches over short distances) if the materials get wet. The existing collapsible soils and undocumented fills within the proposed building pads should be removed and replaced as properly compacted fill, where not removed by cut. The building pad includes any attached structures, including canopies, storage areas, trash enclosures, etc.

Through design, the project will incorporate structural designs that will avoid impacts due to any adverse soil conditions on the site. Proposed structures are expected to be three stories or less in height, and can be supported on spread footings founded on properly compacted fills (GPI, 1999). Slab-on-grade floors are anticipated. Lighter buildings, with no basements, can be supported on spread footings established in undisturbed natural soils or properly compacted fill, imposing relatively low soil pressures. It is estimated that loads up to 700 kips can be safely supported by the on-site soils within total and differential settlements on the order of one inch and one-half inch, respectively (GPI, 1999). If significantly heavier/lighter structures are planned in the future, deeper removal or pile foundations may be required (GPI, 1999).

Collapsible soils in the building areas will be mitigated to below a level of significance through the excavation and recompaction of these soils in place, as identified in Mitigation Measure 3.3. In addition, potential subsurface water sources (i.e., planters) will be required to be lined and drained to appropriate collection facilities, as outlined in Mitigation Measure 3.4. Implementation of Mitigation Measures 3.3 and 3.4 will reduce potentially significant effects to collapsible soils to below a level of significance.

Significant Impacts

There are no significant geotechnical related impacts associated with Development Option D1-C.

4.3.16 MITIGATION MEASURES - DEVELOPMENT OPTION D1-C

The mitigation measures for Development Option A also apply to Development Option D1-C.

4.3.17 CUMULATIVE IMPACTS - DEVELOPMENT OPTION D1-C

Similar to Development Option A, project impacts are site specific. Development Option D1-C project impacts are mitigated individually, and will not have a significant, cumulative impact in terms of geologic/soil conditions.

4.3.18 LEVEL OF SIGNIFICANCE AFTER MITIGATION - DEVELOPMENT OPTION D1-C

Similar to Development Option A, Development Option D1-C will not result in any significant, unavoidable impacts related to geology or seismicity.